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Hot Water Treatment of Potatoes for Golden Nematode Control -
Results of Tests with Commercial Treating Equipment
at the Produce Growers, Inc. Packing Shed
Hicksville, Long Island, August 24, and 25, 1948.

GENERAL

These tests were supplementary to the laboratory experiments on hot water treatment of potatoes that were reported in H.T.&S. Office Report No. 192. The potatoes were treated with the commercial treating and washing equipment that was installed recently in the Produce Growers packing shed at Hicksville, Long Island. Since the hot water treating equipment is not yet being used in the regular grading and packing operations, the observations and data reported here are based on only two test lots of potatoes that were run through the machine.

OBJECTIVES

The purpose of these tests was to see what effect the hot water treatment would have on the keeping quality of potatoes when made with the commercial treating and grading equipment. (The laboratory tests had indicated that the margin of safety with immature potatoes was so narrow that the treatment was likely to cause the potatoes to rot). Data also were obtained on the rate of rise in temperature of the potatoes in the treating tank and the rate of cooling after bagging.

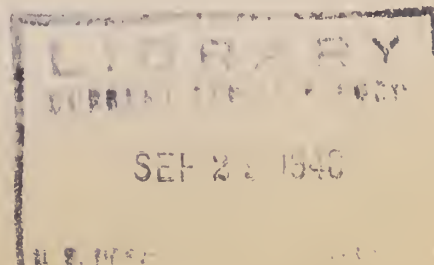
EQUIPMENT

The treating and grading equipment was manufactured by the Food Machinery Corporation and consisted of the following series of machines - a spray type of washer, a covered hot water tank about 50 feet long, another spray washer to cool the potatoes as they leave the hot water, a hot air drying tunnel, a sizer and a picking belt. The speed of the conveyor in the hot water tank was adjusted so as to give the potatoes a five minute immersion in the hot water. Temperatures were obtained by means of thermocouples and glass fruit thermometers.

RESULTS

1. Rate of rise in temperature of potatoes in the hot water tank.

These data were obtained by inserting thermocouples at depths of 1/4 inch, and 1 inch in potatoes which were then tied to a broomstick and inserted in the water through the top of the treating tank. Temperature readings were taken before the potato was put in the hot water and at 1 minute intervals thereafter. Waterproof adhesive tape was used to fasten the thermocouples securely in the potatoes. The temperature of the water was taken with a thermocouple fastened to the stick alongside the potato. These data are shown in the graph in figure 1.



The temperature of the bath was intended to be 132°F. but had fallen below that point during part of the test as is shown by the lines for the water temperature for the third and fourth trials. . However, the curves for the different trials are similar and indicate the rate of temperature rise that may be expected during the treatment. The average rise in temperature for the potato flesh was 31.1°F. at 1/4 inch and 7.5° at 1 inch. Temperatures ranged from 109°-115° at the 1/4 inch depth and from 83.4° to 91.1°F. at the 1 inch depth at the end of the 5 minute period.

2. Rate of cooling of treated potatoes.

The rate of cooling was measured after the potatoes had been treated, dried and bagged in 100 pound burlap and 50 pound triple layer paper sacks. Thermocouples were inserted in a potato at the center and top of each sack. The measurements were made in two paper sacks, ~~two~~ burlap sacks of treated potatoes and two burlap sacks of untreated potatoes. The data are given in table 1 and the averages are shown in the graph in figure 2. The first reading was made immediately after all of the thermocouples were in place which was about 10 minutes after the potatoes were bagged.

Table I

Rate of Cooling of Treated and Sacked Potatoes.

Time of Reading	Air Temp.	Cloth Sack Untreated		Cloth Sack Treated		Cloth Sack Treated		Paper Sack Treated		Paper Sack Treated	
		Center	Top	Center	Top	Center	Top	Center	Top	Center	Top
11:55AM	88.0	77.1	82.7	99.0	99.5	95.3	95.9	93.1	97.9	97.0	94.4
12:10PM	87.1	77.0	82.7	98.0	98.7	94.0	95.7	94.4	97.9	97.3	93.7
1:30PM	90.1	77.2	83.1	92.6	93.8	89.0	93.7	95.5	95.7	96.2	93.9
2:00PM	91.2	77.6	83.9	90.9	92.3	87.8	93.1	94.8	94.8	95.3	94.0
2:30PM	92.0	77.7	84.5	89.8	91.5	86.9	92.7	94.3	94.3	94.6	94.0
3:15PM	93.3	78.0	84.9	88.0	88.9	84.8	91.2	93.3	93.3	93.6	93.3
4:10PM	93.7	78.8	85.5	86.6	87.1	83.6	89.7	92.7	93.0	92.6	92.9

The data show that 4 1/4 hours after bagging, the temperature of the treated potatoes was still considerably higher than that of untreated potatoes and that those in the paper sacks cooled much more slowly than those in burlap bags. The temperature of the potatoes in the burlap bags dropped 2.84°F. per hour at the center and 2.19° at the top, but in the paper sacks the temperature dropped only 0.56° per hour at the center and 0.75° at the top. The air temperature during the period went up 5.7° or at the rate of 1.59° per hour. At the air temperatures prevailing during these observations, it would have taken approximately 31 hours for the potatoes at the center of the paper sack to cool to 78.8° (the temperature of the check) and 6 1/2 hours for the potatoes in burlap sacks to cool to that degree. It is evident that temperatures in either burlap or paper sacks would be likely to remain undesirably high for a long time unless refrigerated and provided with abundant air circulation. Potatoes in a stack would have cooled even more slowly than those in the individual sacks used in this test.



3. Keeping quality of treated and untreated potatoes.

Potatoes harvested and loaded on a truck in the morning and treated in the afternoon were used for the test on the keeping quality. These were treated at 132°F. for 5 minutes. The potatoes were moderately mature and skinned very little during the washing and drying process. Since the truck load had been exposed to the sun until afternoon and potatoes on the top of the load were likely to have suffered heat injury, the top layer of sacks were treated separately from the others. The temperature of the potatoes on the exposed side of the top layer of sacks averaged 98°F. and those on the underside of the sacks averaged 79°. Two 50 pound triple layer paper sacks of treated and untreated potatoes from the top of the load and the same from the bottom of the load were taken to the New York Laboratory and held at room temperature for two days. Odor from the sacks one day after treatment indicated that decay was already taking place and examination on the second day showed that practically all of the treated potatoes had decayed. The decay was similar in appearance to that resulting from heat injury from exposure to the sun. There was no significant difference in amount of decay in the potatoes from the center and top of the truck load. The amount of decay is shown in table 2.

Table II

Condition of Potatoes Two Days after Treatment

Treatment	Number of Potatoes		Percentage
	Sound	Rotted	Rotted
Top of Load Untreated Sack 1	220	1	0.45
Top of Load Untreated Sack 2	220	1	0.45
Top of Load Treated Sack 1	4	195	97.99
Top of Load Treated Sack 2	1	187	99.47
Center of Load Untreated Sack 1	179	0	0
Center of Load Untreated Sack 2	143	0	0
Center of Load Treated Sack 1	6	181	96.79
Center of Load Treated Sack 2	1	91	98.91
Average for Untreated	190.5	0.5	.26
Average for Treated	3.0	163.5	98.19

CONCLUSION

The data on keeping quality of the hot water treated potatoes is further evidence that treatment at 132°F. for 5 minutes is likely to cause decay. In view of the results obtained in this and the previous tests this treatment is not considered satisfactory for commercial use.

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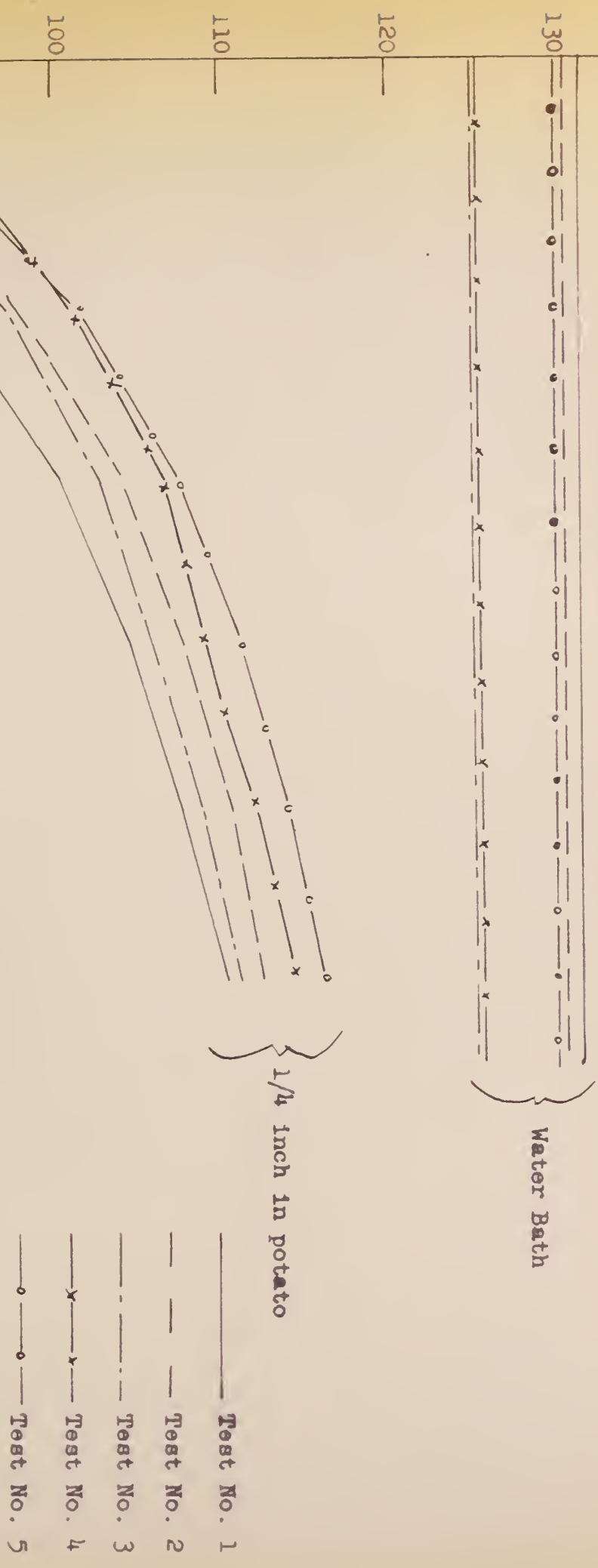
Beltsville, Maryland
September 14, 1948



TEMPERATURE °F.

RATE OF RISE IN TEMPERATURE IN HOT WATER TANK

Figure 1.





TEMPERATURE °F.

Figure 2
Rate of Cooling After Treatment and Bagging

